____ WELDING REINFORCEMENT BARS

NOTE TO SPECIFIERS: Refer to drawings 40-D-5603, 40-D-5604, and 40-D-5605.

a. General. - Reinforcement bars shall be welded only when shown or called for on the drawings. Welding may be performed by the shielded electric-arc method, flash-pressure welding process, Thermit welding, or other processes approved by the Contracting Officer. The Contractor shall provide all necessary machines, materials, and equipment for end preparation, heating and welding of the bars, and for preparation of specimens for testing.

b. Qualification of welders. - Qualification tests for welders or for procedures will be required to be made by the Contractor as described in this paragraph. The Contractor shall furnish certificates from an approved testing laboratory indicating ability of welders or equipment to perform satisfactory work under the conditions set forth below. The certificates shall, to be acceptable, refer specifically to the type of welding for which the welder or the equipment is to be used.

Materials for qualification tests shall be taken from reinforcement bars used under these specifications. During the welding program, two soundness test or nick-test specimens shall be prepared and tested during each working shift, which number may be increased at the option of the Contracting Officer if the tests do not fully meet the requirement.

The Contracting Officer shall have the right at any time during the welding program to call for the preparation of tension test specimens similar to the qualification test specimens and have such specimens tested to determine whether production welds meet the physical requirements. These production test specimens shall be furnished by the Contractor for testing by the Government.

Tension tests will be considered satisfactory if the minimum yield point and the tensile strength are not less than 90 percent of specified minimum yield point and minimum tensile strength of the reinforcement material. Soundness or nick-break tests to be acceptable shall show complete fusion, absence of oxide or slag inclusion, and a degree of porosity not exceeding six gas pockets of 1/16 of an inch maximum dimension per square inch of total area of weld surface exposed in fracture.

Defective welded joints shall be separated by flame cutting and rewelded.

c. Shielded-arc welding. -

(1) General. - Bars smaller than No. 8 shall be lap welded, and bars No. 8 and larger shall be butt welded. Surfaces to be welded shall be clean, free of slag, and dry while welding. When the temperature of the bars is below 50 EF, No. 5 bars and larger shall be preheated to 100 EF at the ends for a distance of 4 inches for lap welding and for a distance of 2-bar diameters for butt welding.

Low hydrogen electrodes conforming to classification E-7015 or E7016 of AWS shall be used. The low hydrogen electrodes shall be furnished and stored in airtight containers. Electrodes exposed to air longer than 12 hours will be rejected unless reclaimed by drying at a temperature of 400 EF for a period of 1 hour immediately prior to use. Electrodes which have been in direct contact with water will be rejected. The arc length shall be held as short as possible. The amperage should be as high as recommended by the electrode manufacturer and shall never be less than 140 amperes. The electrode shall be slanted not more than 15E away from right angles to the work. Welding shall be done flat or uphill. Weaving shall be limited to twice the finished diameter of the electrode. Several joints shall be prepared and welded concurrently by one welder in such a manner that slag removal and laying down additional passes prolong the cooling time of the welded bars.

(2) Lap splices. - All lap splices shall be made by fillet welds on both sides as shown on drawing ____ (40-D-5063). The bars shall be lapped and tied with tie wire to align the ends of the bar and shall be securely held during welding. The root opening shall be controlled by the deformation of the bars. For No. 5 bars and smaller, the weld material may be deposited in one pass. For No. 6 and 7 bars, two or more passes shall be used to deposit the weld material.

(3) Butt splices. - Butt welds can be made for bars in horizontal, inclined, or vertical position. Depending on the position of the bars, the ends of the bars shall be prepared as shown on drawing ____ (40-D-5603). Backup strips shall be used for bars in horizontal and inclined positions. The bars shall be held securely in place during welding. The weld metal shall be deposited in several passes. Laying down all of the metal in one pass will not be permitted.

(4) Qualification of welders. - The number and type of welding tests for qualification of welders for shielded-arc welding shall be made as follows:

(a) (Reference drawing ____ (40-D-5604).) One lap weld and one soundness test specimen, both welded horizontally for one No. 5 and one No. 7 bar as shown in figures 1 and 4. One lap weld and one soundness test specimen both welded vertically for one No. 5 and one No. 7 bar as shown in figures 2 and 4. One lap weld and one soundness test specimen both welded overhead for one No. 5 and one No. 7 bar as shown in figures 3 and 4.

(b) (Reference drawing ____ (40-D-5605).) One butt weld for bars placed horizontal for two No. ____ bars as shown in figure 1. One butt weld for bars placed vertically for two No. ____ bars as shown in figure 2. One butt weld in overhead position for two No. ____ bars as shown in figure 3. One double "V" butt weld for bars placed horizontal for two No. ____ bars as shown in figure 4.

Welding electrodes for tests shall be as specified in subparagraph c.(1), and the diameter of the core wire shall be 5/32 inch.

Bars for lap splices shall be wired together similar to that used in placing reinforcement. Bars for butt splices shall be cut by applicant by use of the cutting torch and other tools used in construction. Bar ends shall be prepared to the bevels and to the cleanliness required for sound work.

The welder shall satisfy himself regarding cleanliness of bars before he begins welding, shall demonstrate familiarity with E7015 or E-7016 electrodes, shall use proper technique and understand the need for protecting the coating of the electrode against moisture pickup. The certificate shall report on the applicant's knowledge of the above requirements.

Lap welds and one of each of the butt welds shall be subjected to tensile tests to failure. For tensile tests of lap welds, a jig shall be used to prevent distortions due to eccentricities of lapped bars. Each lap splice shall be visually examined after test to failure and then sawed through an average section of the unbroken portion, and the dimensions of the weld shall be within the limits given in figure 5, drawing ____ (40-D-5604). Each of the soundness test specimens shall be broken by a loading which causes the root to open. The surfaces of the fracture shall be visually examined for soundness as described by the AWS Handbook for "Fillet-Weld-Break Test."

One each of the butt-weld specimens shall be saw-notched as shown in figure 5, drawing ____ (40-D-5605), for a nick-break test and shall be broken and visually examined for soundness as described by the AWS Handbook for "Welded Butt Joints" nick-break tests.

d. Flash-pressure welding. -

(1) General. - The ends of the bars to be joined by welding shall be squared off by flame cutting, and any accumulation of dirt or oxide film formed by the cutting operation shall be removed by sandblasting or buffing prior to welding. Ends of bars to be joined shall be cleaned of all rust and projections on all faces for a distance of about 6 inches from the ends, if necessary to prevent arcing. The bars shall be securely held in position with a prescribed pressure applied prior to heating and during heating and welding. The prescribed pressure shall conform to the recommendations of the equipment manufacturer.

(2) Qualification tests. - To demonstrate the acceptability of the welds made by flash-pressure welding, qualification tests for welds shall be made as follows:

Four test welds for each bar size and for each operator using the same end preparation, pressures, heating, and upsetting as will be used for the reinforcement. The test bars shall be not less than 24 inches long after welding. Two of the test welds for each bar size and for each operator shall be tested for tensile strength and the other two shall be saw-notched one-fourth of an inch deep for nick-break specimens. The nick-break

specimens shall be broken and visually examined for soundness as described by the AWS Handbook for "Welding Butt Joints," nick-break test.

e. Thermit welding. -

(1) General. - The ends of the bars to be joined by welding shall be square shouldered and may be sheared or flame cut. The ends of the bars to be joined shall be cleaned of all dirt and rust on all faces for a distance equal to the length of the mold. The method and control of welding process shall conform to recommendations of the equipment manufacturer.

(2) Qualification tests. - To demonstrate the acceptability of the welds made by thermit welding, qualification tests for welds shall be made as specified in subparagraph d.(2) for flash-pressure welding.

f. [1](Payment. - The cost of welding reinforcement bars, qualification tests, and furnishing of production welding test specimens as described in this paragraph shall be included in the unit price per pound bid in the schedule for furnishing and placing reinforcement bars. The weight of electrodes and materials used for qualification and production test specimens will not be included in the pay weights.)

[1](Payment for welding reinforcement bars as described in this paragraph will be made at the unit price per weld bid in the schedule for each size of bar. No payment will be made for welds made for qualification and production test specimens.)

---

[1]Delete or revise as required.